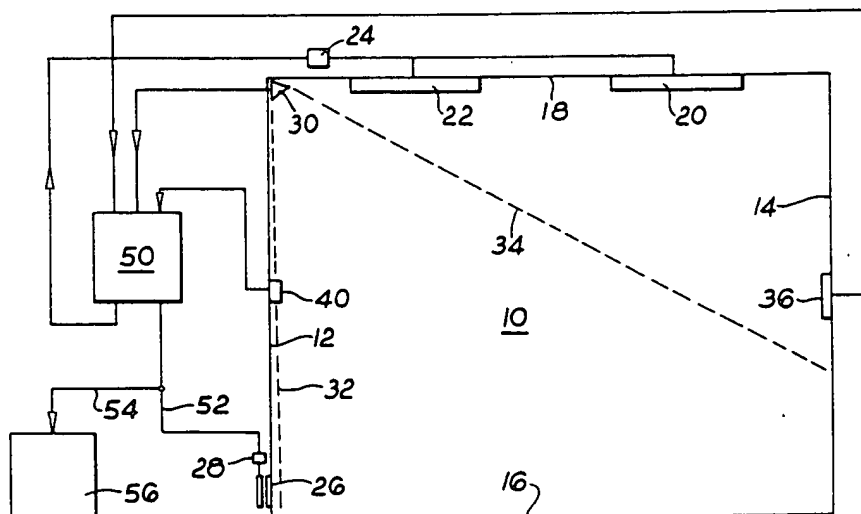




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification<sup>4</sup> :</b> <b>H05B 37/02, G05D 23/19</b> <b>G08B 13/00</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 85/ 05753</b> <b>(43) International Publication Date:</b> 19 December 1985 (19.12.85)
<b>(21) International Application Number:</b> PCT/GB85/00232 <b>(22) International Filing Date:</b> 31 May 1985 (31.05.85) <b>(31) Priority Application Number:</b> 8413951 <b>(32) Priority Date:</b> 31 May 1984 (31.05.84) <b>(33) Priority Country:</b> GB		<b>(74) Agent:</b> GOODMAN, Christopher; Eric Potter & Clark-son, 14 Oxford Street, Nottingham NG1 5BP (GB). <b>(81) Designated States:</b> AT (European patent), BE (Euro-pean patent), CH (European patent), DE (European patent), FR (European patent), GB, GB (European patent), IT (European patent), LU (European patent), NL (European patent), SE (European patent), US.
<b>(71) Applicant (for all designated States except US):</b> ROBO-TRONICS LIMITED [GB/GB]; Units 5 & 6, Priory Road Industrial Estate, St. Nicholas Road, Beverley, North Humberside HU17 0EG (GB). <b>(72) Inventor; and</b> <b>(75) Inventor/Applicant (for US only) :</b> BIRD, William, De-rek [GB/GB]; 3 Primrose Avenue, Newark, Nottingh-amshire NG24 2AQ (GB).		<b>Published</b> <i>With international search report.</i>

(54) Title: ENERGY CONTROL SYSTEM



**(57) Abstract**

An energy control system for the control of energy consumption within an area including detection means for detecting the presence of a person within the area and control means responsive to the output of the detection means to control the energy consumption within the area. The system can also be used as a burglar alarm by turning lighting on if an intruder enters the defined area.

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ENERGY CONTROL SYSTEM

The present invention relates to energy control systems and more particularly to the control of the use of energy consuming apparatus within a defined area or areas.

5       At present in known systems for use in energy control of heating and light apparatus within a defined area a number of different devices are used. To conserve energy in heating a room in a building thermostats are used either on individual radiators or a conveniently situated  
10 room thermostat may be used. Additionally the heating system is normally on a timer to conserve heat for example at night and over weekends. For lighting control a timing circuit is often used particularly for communal areas such as stairs wherein operation of the timing circuit switches on the light for a few minutes to allow the  
15 normal passage through the area.

The above known systems suffer from a number of disadvantages. Firstly in respect of the heating of a building the timer is normally set to cover all hours  
20 that the building would be occupied. Thus in respect of commercial premises this would cover the period from eight in the morning to eight at night allowing for overtime working and for cleaning. Also unless a complex seven day timer is installed the heating will be on all  
25 day Saturday and Sunday. Similarly for lighting purposes in large office or school premises the lights tend to be turned on when darkness falls and left on until the night watchman or caretaker turns them off or turned on the morning and left on all day even when not required.

30       It is an object of the present invention to provide an energy control system which reduces energy consumption by automatically controlling the lighting and/or the heating or the like in a building or part of a building to minimise the energy used whilst ensuring good environ-

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mental working conditions for employees. The consumption of power by heating and/or lighting or the like will hereinafter for brevity be referred to generally as energy consumption.

5       According to the present invention there is provided an energy control system for the control of energy consumption within an area including detection means for detecting the presence of a person within the area and control means responsive to the output of the detection  
10 means to control the energy consumption within the area.

Preferably the detection means includes an infrared or microwave sensor or a sensor with combined infrared and microwave detection sensitivity.

In a preferred embodiment the control means also  
15 includes means for detecting ambient light conditions for switching on lights when a predetermined inadequate low level of lighting is present and for switching off lights when a predetermined adequate higher level of lighting is present.

20       Also preferably the control means includes a temperature detector which is operative with the control means to switch on the heating in an area only when the temperature falls below a specified first level and providing that the presence of a person is detected and to switch  
25 off the heating when the infrared or microwave sensor does not sense any person in the controlled area.

The control means preferably includes a second temperature detector to maintain the temperature in the controlled area at a second low level to prevent freezing  
30 within the controlled area.

Since the lights are, in a preferred embodiment, turned on by the intrusion or presence of a person within a defined area this may be linked to a burglar alarm system and will turn on the lights enabling the intruder  
35 to be easily seen. The mere action of switching on the

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lights may act as a suitable deterrent and an audible or remote alarm may also be given.

Embodiments of the present invention will now be described, by way of example with reference to the accompanying drawings in which:-

Figure 1 shows a room equipped with an energy control system according to the present invention;

Figure 2 shows in block diagrammatic form the circuitry of the control box of the energy control system of Figure 1 in greater detail; and

Figure 3 shows the circuitry of Figure 2 in greater detail.

With reference now to Figure 1, a room or area 10 is depicted by two walls 12, 14 and a floor 16 and ceiling 18. The area is lit by ceiling light fittings 20, 22 preferably of the fluorescent type controlled by a switch 24. The area is heated by, for example, warm air central heating through vents 26 controlled by one or more shut off grills 28. Water filled radiators and valves may be substituted for the warm air heating in known manner.

The area 10 may be a workshop, office or hallway and at a suitable vantage point a detector 30 is mounted such that it can detect the presence of a person within the area 10. The detector may be of the microwave type or of the infrared type or may be a combined microwave and infrared detector. The detector will continuously detect the presence and movement of any person within the area 10 as shown by dotted lines 32, 34.

An ambient light sensor 36 is situated at a location within area 10 that is chosen such that the ambient light level at this location is representative of the ambient light within the area 10. Thus the sensor 36 should not be situated too close to a window, nor in an obscure corner since both locations would be non representative of the light conditions in the area generally.

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A room thermostat 40 is mounted on a convenient wall 12 and is used in known manner to monitor the temperature within the room 10.

5 Preferably the thermostat 40 includes a low level second temperature (e.g. 40°F) which is maintained even when the area is not inhabited.

10 The outputs of ambient light sensor 36 are connected to a control box 50 which produces outputs to control switch 24 and grill 28 as explained hereinafter. The thermostat 40 is only enabled when the detector senses the presence of a person in the area.

15 The control box 50 includes circuitry shown in greater detail in Figure 2. Provided the room or area 10 is inhabited then, as ambient light diminishes lighting will be automatically switched on by operation of relay switch 24. This could occur for example during heavy rain or a thunderstorm. Following this event as ambient light increases the lights would be switched off. If the room or area 10 is not inhabited then the lights will not  
20 be operated.

When the room or area 10 is vacated then if the lights are on they will be switched off after a defined delay period (say ten minutes).

25 The control unit is continuously monitoring such that if an intruder enters the area 10 the lights would immediately be switched on and thus deter entry into this area. If an area contains many obstructions such as a warehouse then an acoustic detector may be used. The acoustic detector can be selectively filtered to ignore  
30 any continuous noises e.g. machinery such as air conditioning fans.

Under normal circumstances a timer within the control box, which produces the time delay for switching off the lights, is continually reset by detected noise, heat  
35 or movement of an inhabitant of the area such that the

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lights will remain on continuously.

The advantages of such a system are that the timers are totally variable thus allowing switch off after very short or long periods of time to suit individual requirements.

If an acoustic infrared or microwave sensor is used then the sensitivity can be preset according to the type of location of the establishment containing area 10. Thus any inherent noise levels or heat sources can be compensated for.

A reduction in energy consumption can be achieved even for very short periods for example break periods, lunch periods and intervals between classes in a school. Also between the end of day time classes and the commencement of evening classes.

The system when installed in shops and warehouses acts as an anti-vandal and/or anti-theft device.

In the system of Figure 1 the heating can be controlled at the same time as the lighting. Thus an output on line 52 to shut off grill 28 can eliminate area 10 from the main heating changing thermostat 40 over to the low temperature standby mode. Alternately if the building comprises only area 10 then an output may be sent on line 54 to shut down the heating boiler 56.

Thus in a complete system both heating and lighting energy consumption is reduced even during short periods.

A more detailed circuit diagram of the control box 50 is shown in Figure 2. The power for the circuitry is obtained from a mains supply (normally 240 volts) 100 which is transformed and rectified in known manner in circuit 102 to give a 12 volt output 104. This 12 volts output is used to power four integrated circuits 106, 108, 110, 112 as shown and the other circuitry comprising first and second relays 114, 116.

The first relay 114 is an input sensing relay which

is operated by the sensor to give an output when the sensor senses the presence of a person within the room and this relay provides when actuated an input to first logic circuit 106. The output of logic circuit 106 is fed to  
5 the second relay 116 and also to a second logic circuit 108. The output of second logic circuit 108 is fed to a timing circuit 110 the output of which is fed also to relay 116.

The integrated circuit 112 is a comparator and the  
10 circuit compares the set light level with the present or ambient level sensed by sensor 36. If the ambient light level is too low a signal is sent to logic circuit 106 to attempt to turn the lights and/or heating on by operation of relay 116. This will only occur however if the sensor  
15 indicates the presence of a person in the defined area.

The second logic integrated circuit 108 is used to instruct the timing circuit 110. If for example the last person leaves the defined area then sensors 30 will attempt via logic circuit 30 to put out the lights and/or  
20 turn off the heating. The timer 110 will prevent this for a predetermined time set by the user according to the desired use in order for example for the person to be able to step into an adjoining store room and then move back in to the area within say five minutes. Similarly  
25 if the light sensor detects low ambient light and the sensor 30 does not detect any presence within the defined area then the logic circuit 106 will prevent actuation of relay 116 because there will be no requirement for any lighting or heating.

30 The heating may be controlled either directly by relay 116 or by a similar separate relay (not shown) to turn on the heating boiler or a separate set of make contacts of relay 116 may be used in series with a room thermistor 40. In the latter case if thermistor 40  
35 senses too low a temperature it will attempt to turn on



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the boiler. If relay 116 is not operated however there will be no continuous connection and the boiler will not operate. If relay 116 is then operated on sensing the entrance of a person the circuit will be completed and  
 5 the boiler or shut off grills 28 will be activated to provide heat within the area.

If a microwave detector is used then this will detect movement within the defined area. Thus if a person bends down behind an obstacle such as a cabinet for a  
 10 short period the sensor will be de-activated. However timer circuit 110 will keep the lights on for the pre-set time and therefore there will for most normal circumstances be no premature switching off of the lights.

A more detailed circuit diagram of the block diagram  
 15 of Figure 2 is shown in Figure 3 the significant circuits being identified by the same reference numerals. The circuit values and types for the circuit are as follows:-

IC1 (106)	CMOS4081 AND GATE LOGIC
20 IC2 (108)	COS4803 OR GATE LOGIC
IC3 (110)	555 TIMING CIRCUIT
IC5 (112)	311 COMPARATOR
R1	4.7 K ohms TIMER VARIATION POTENTIOMETER
25 R2,R3,R5,R6	1 K ohms
R4	1 M ohms
R7	22 K ohms
D1 -D7	IN4148
C0	47 $\mu$ F
30 C1	0.01 $\mu$ F
C2	220 $\mu$ F
C3,C4	0.1 $\mu$ F
RL1,RL2	Radiospares 347-832 (8410) 12 volt DC
	205 ohms

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By controlling the lighting relay 116 can, following  
 actuation of a time switch in a known burglar alarm syst-  
 em, be used not only to switch on the lights by also to  
 actuate a burglar alarm. This can be either a local bell  
 5 or a silent or remote alarm. The burglar can therefore  
 be identified by virtue of the light being turned on and  
 the area within which the burglar is present can be read-  
 ily seen. In the case of a shop the shop can be easily  
 identified by the switching on of the shop sign as well  
 10 as the interior lights.

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CLAIMS

1. An energy control system for the control of energy consumption within an area including detection means for detecting the presence of a person within the area and control means responsive to the output of the detection means to control the energy consumption within the area.
2. An energy control system as claimed in Claim 1 in which the detection means includes an infrared, a microwave or combined infrared and microwave detector.
3. An energy control system as claimed in Claim 1 or Claim 2 in which the control means includes means for detecting ambient light conditions to switch on lights within the area when a predetermined inadequately low level of lighting is detected and means for switching off the lights in the area when a predetermined adequate higher level of lighting is present.
4. An energy control system as claimed in any preceding claim in which the control means includes a temperature detector which is operative to switch on the heating in the area when the temperature falls below a specific first level providing that the presence of a person is detected and to switch off the heating when the detection means does not sense any person in the controlled area.
5. A burglar alarm system for the detection of intruders within an area including detection means for detecting the presence of a person within the area and control means responsive to the output of the detection means to turn on the lighting within the area.
6. A burglar alarm system as claimed in Claim 5 in which the control means also actuates an alarm.
7. An energy control system constructed substantially as herein described with reference to the accompanying drawings.
8. A burglar alarm system substantially as described with reference to the accompanying drawings.

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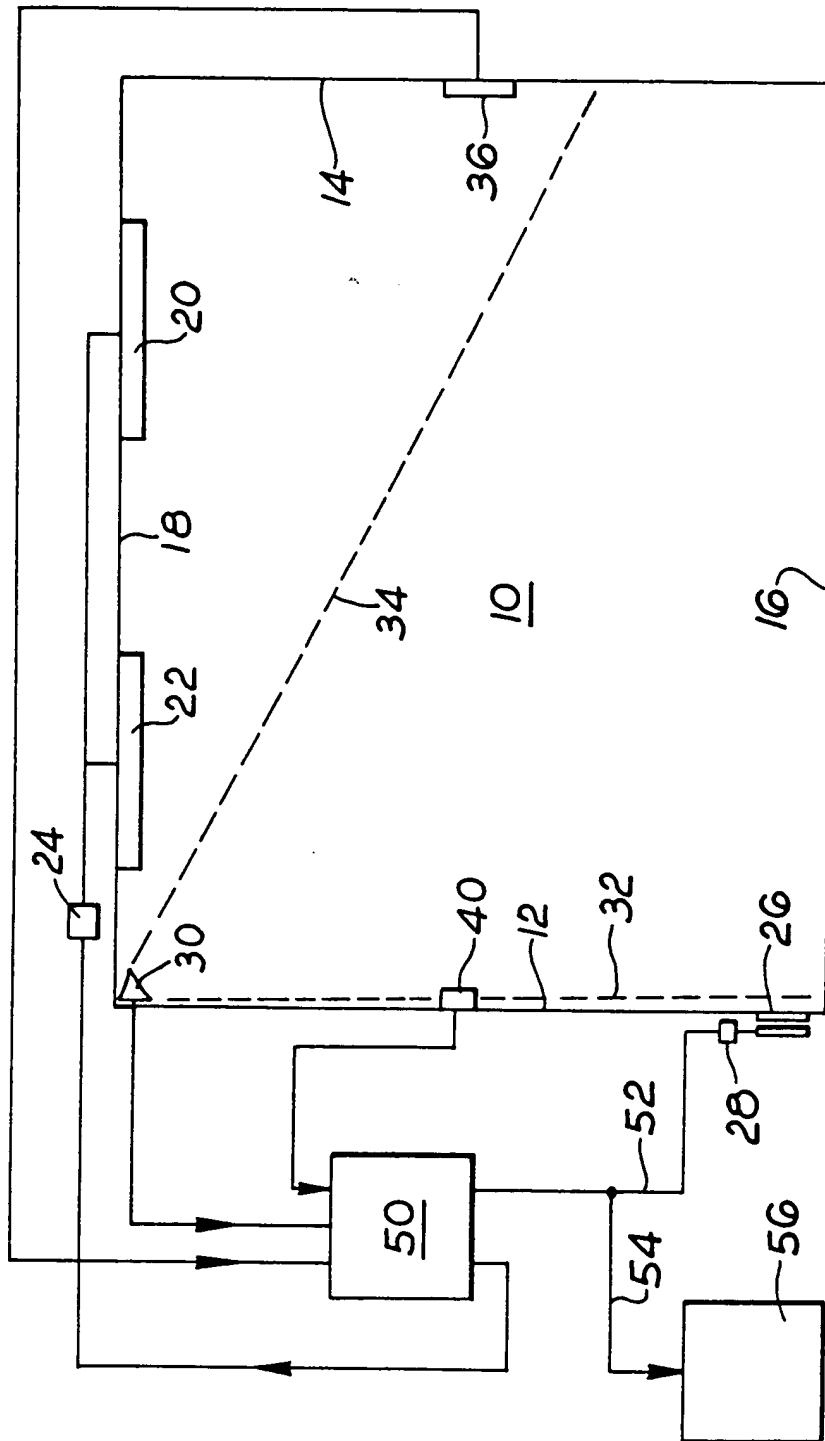


Fig. 1

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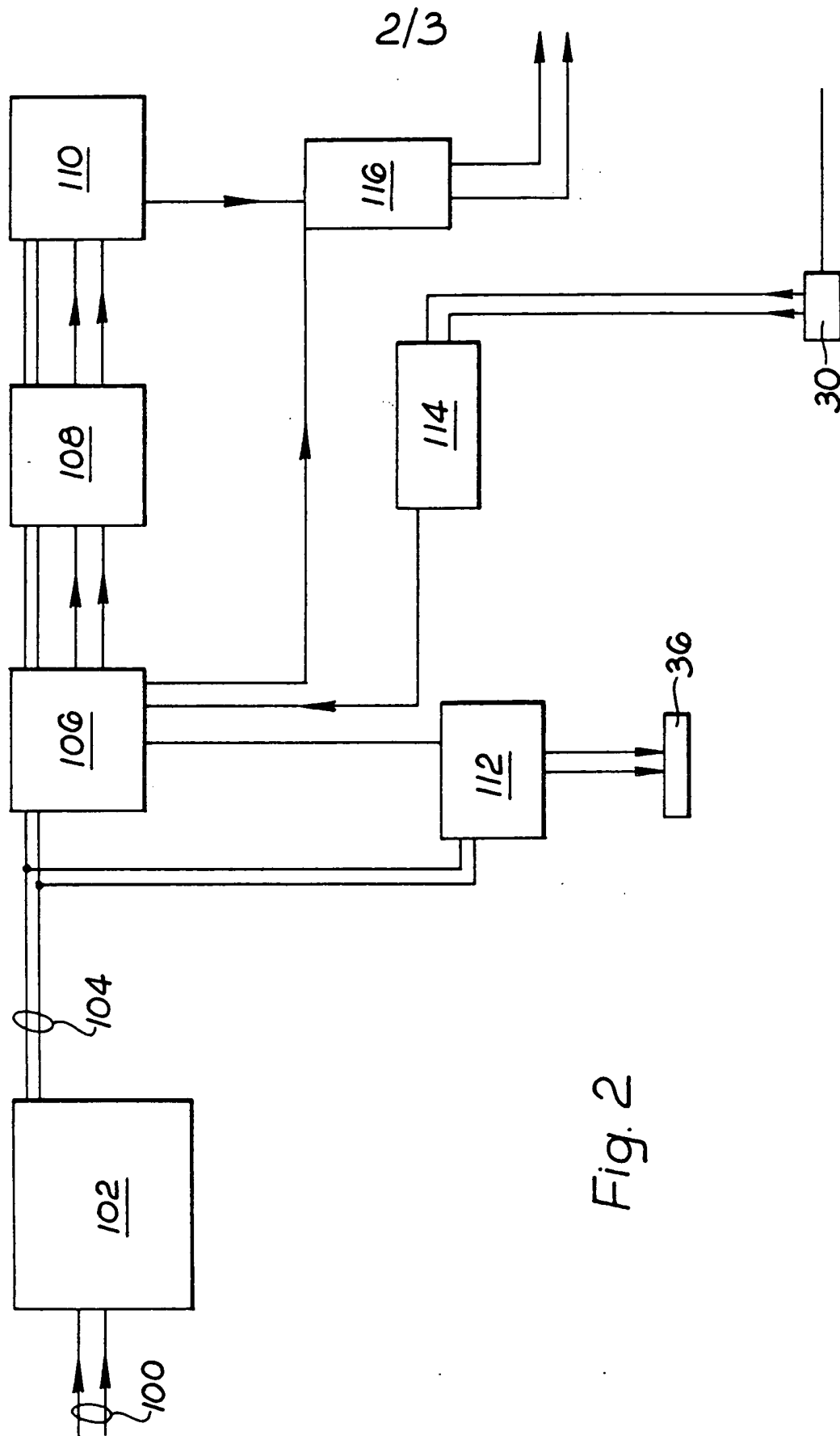


Fig. 2

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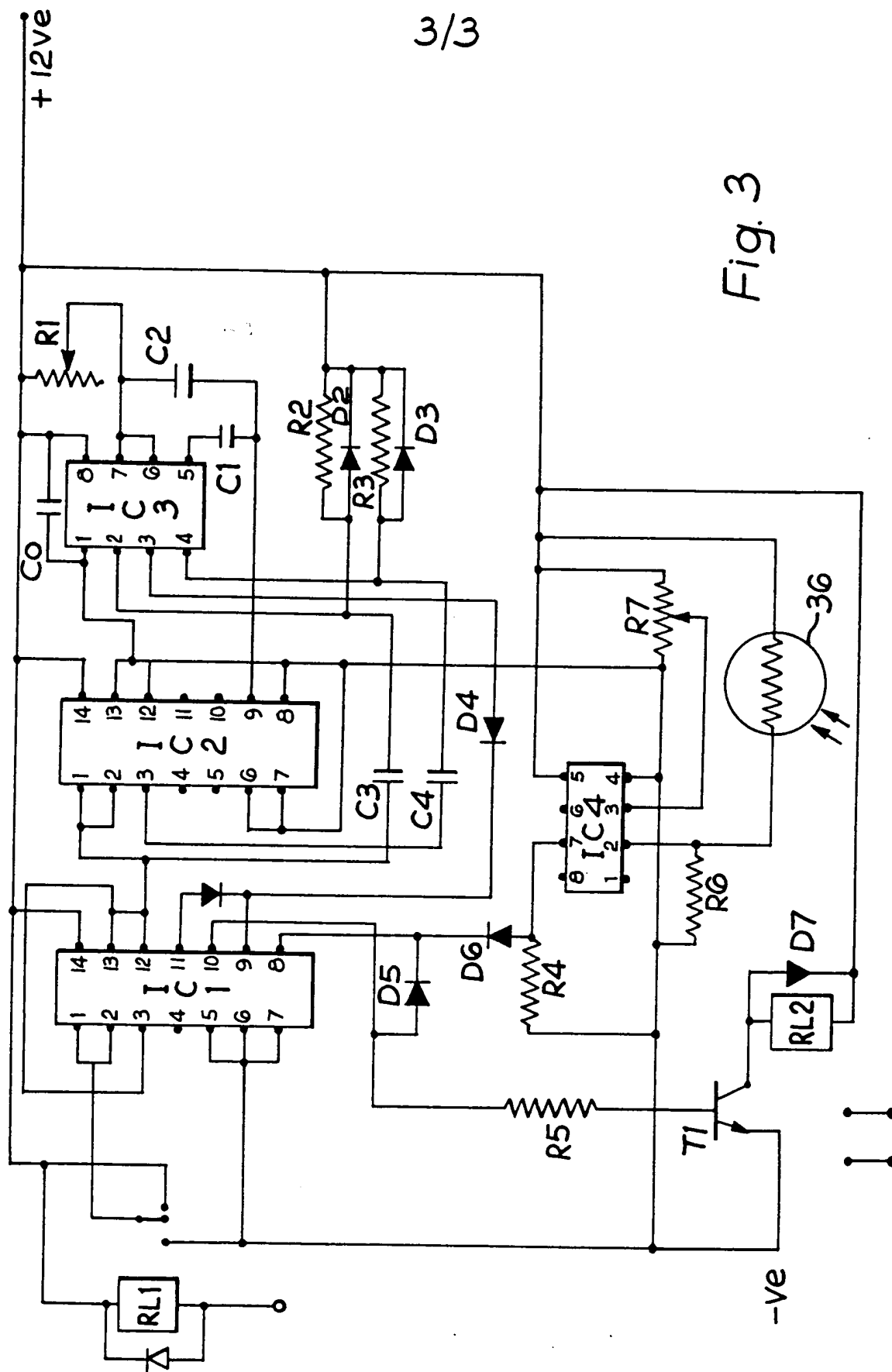


Fig. 3

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# INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 85/00232

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) <sup>6</sup> According to International Patent Classification (IPC) or to both National Classification and IPC IPC <sup>4</sup> : H 05 B 37/02; G 05 D 23/19; G 08 B 13/00																										
<b>II. FIELDS SEARCHED</b> <div style="text-align: center; margin-top: 10px;">Minimum Documentation Searched <sup>7</sup></div> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 30%; text-align: left; padding: 5px;">Classification System <sup>1</sup></th> <th style="text-align: left; padding: 5px;">Classification Symbols</th> </tr> <tr> <td style="vertical-align: top; padding: 5px;">IPC<sup>4</sup></td> <td style="padding: 5px;">           H 05 B            G 05 D            G 08 B         </td> </tr> </table> <div style="text-align: center; margin-top: 10px;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>8</sup></div>			Classification System <sup>1</sup>	Classification Symbols	IPC <sup>4</sup>	H 05 B G 05 D G 08 B																				
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IPC <sup>4</sup>	H 05 B G 05 D G 08 B																									
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT<sup>9</sup></b> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%; text-align: left; padding: 5px;">Category <sup>9</sup></th> <th style="text-align: left; padding: 5px;">Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup></th> <th style="width: 10%; text-align: left; padding: 5px;">Relevant to Claim No. <sup>13</sup></th> </tr> </thead> <tbody> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">X</td> <td style="padding: 5px;">           WO, A, 82/02608 (RIFTBERRY) 5 August 1982,            see page 1, lines 1-19; page 2, lines 4-28;            page 3, lines 7-18; page 4, lines 1-15;            page 5, lines 10-22; page 6, lines 14-19;            page 9, lines 1-25, page 10, claim 11;            figure 1         </td> <td style="text-align: center; vertical-align: top; padding: 5px;">1,3,4,7,8</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">Y</td> <td style="text-align: center; vertical-align: top; padding: 5px;">--</td> <td style="text-align: center; vertical-align: top; padding: 5px;">2,5,6</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">Y</td> <td style="padding: 5px;">           GB, A, 2106269 (EDA SPARKRITE) 7 April 1983,            see abstract; page 2, lines 3-37; figure 1         </td> <td style="text-align: center; vertical-align: top; padding: 5px;">2</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">Y</td> <td style="text-align: center; vertical-align: top; padding: 5px;">--</td> <td style="text-align: center; vertical-align: top; padding: 5px;">5,6</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">Y</td> <td style="padding: 5px;">           US, A, 4287511 (D. SCOTT) 1 September 1981,            see abstract; lines 34-43; column 4, line 56 -            column 5, line 2; column 7, lines 25-43;            figure 1         </td> <td style="text-align: center; vertical-align: top; padding: 5px;">5,6</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">Y</td> <td style="padding: 5px;">           US, A, 4314238 (W. ROMBAUT) 2 February 1982,            see abstract; column 5, line 15; column 6, line 3;            figures 1,3         </td> <td style="text-align: center; vertical-align: top; padding: 5px;">5,6</td> </tr> <tr> <td colspan="3" style="text-align: center; padding: 5px;">-----</td> </tr> </tbody> </table>			Category <sup>9</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>	X	WO, A, 82/02608 (RIFTBERRY) 5 August 1982, see page 1, lines 1-19; page 2, lines 4-28; page 3, lines 7-18; page 4, lines 1-15; page 5, lines 10-22; page 6, lines 14-19; page 9, lines 1-25, page 10, claim 11; figure 1	1,3,4,7,8	Y	--	2,5,6	Y	GB, A, 2106269 (EDA SPARKRITE) 7 April 1983, see abstract; page 2, lines 3-37; figure 1	2	Y	--	5,6	Y	US, A, 4287511 (D. SCOTT) 1 September 1981, see abstract; lines 34-43; column 4, line 56 - column 5, line 2; column 7, lines 25-43; figure 1	5,6	Y	US, A, 4314238 (W. ROMBAUT) 2 February 1982, see abstract; column 5, line 15; column 6, line 3; figures 1,3	5,6	-----		
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<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p><sup>10</sup> Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"A" document member of the same patent family</p> </div> </div>																										
<b>IV. CERTIFICATION</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; padding: 5px;">           Date of the Actual Completion of the International Search  <div style="text-align: center; margin-top: 10px;">22nd August 1985</div> </td> <td style="width: 50%; padding: 5px;">           Date of Mailing of this International Search Report  <div style="text-align: center; margin-top: 10px;">16 SEP. 1985</div> </td> </tr> <tr> <td style="padding: 5px;">           International Searching Authority  <div style="text-align: center; margin-top: 10px;">EUROPEAN PATENT OFFICE</div> </td> <td style="padding: 5px;">           Signature of Authorized Officer  <div style="text-align: center; margin-top: 10px;">               G.L.M. Kruvdenberg           </div> </td> </tr> </table>			Date of the Actual Completion of the International Search <div style="text-align: center; margin-top: 10px;">22nd August 1985</div>	Date of Mailing of this International Search Report <div style="text-align: center; margin-top: 10px;">16 SEP. 1985</div>	International Searching Authority <div style="text-align: center; margin-top: 10px;">EUROPEAN PATENT OFFICE</div>	Signature of Authorized Officer <div style="text-align: center; margin-top: 10px;">               G.L.M. Kruvdenberg           </div>																				
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ANNEX TO THE INTERNATIONAL SEARCH REPORT ON

INTERNATIONAL APPLICATION NO. PCT/GB 85/00232 (SA 9719)

This Annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 05/09/85

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO-A- 8202608	05/08/82	EP-A- 0069745	19/01/83
GB-A- 2106269	07/04/83	None	
US-A- 4287511	01/09/81	EP-A- 0027738	29/04/81
		JP-A- 56153492	27/11/81
		US-A- 4398184	09/08/83
		US-A- 4419900	13/12/83
US-A- 4314238	02/02/82	NL-A- 8000145	14/07/80
		FR-A,B 2446578	08/08/80
		DE-A,C 3000301	07/08/80
		GB-A- 2062982	28/05/81
		CA-A- 1127705	13/07/82
		CH-A- 637515	29/07/83

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